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Java Foundations

2-3

Introduction to Object-Oriented Programming Concepts

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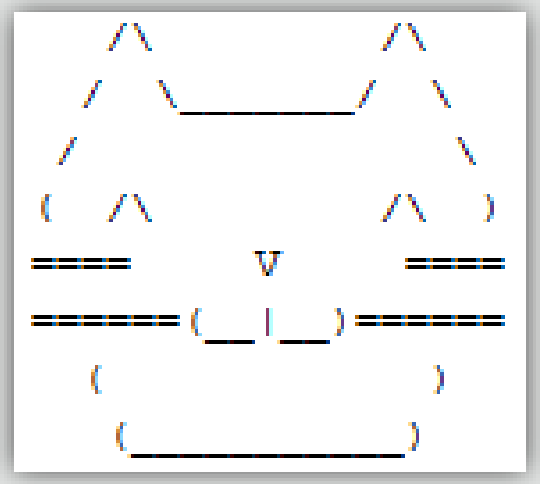
Objectives

- This lesson covers the following objectives:
  - Differentiate between procedural and object-oriented programming
  - Understand a class as a blueprint for an object
  - Understand a class is used to create instances of an object
  - Model objects as a combination of …
    - Properties (data fields)
    - Behaviors (methods)

Review

- So far, we've taken …
  - Decades of computer science innovation
  - Gigabytes of modern computing power

- And much like the Internet …
  - We've made a cat!



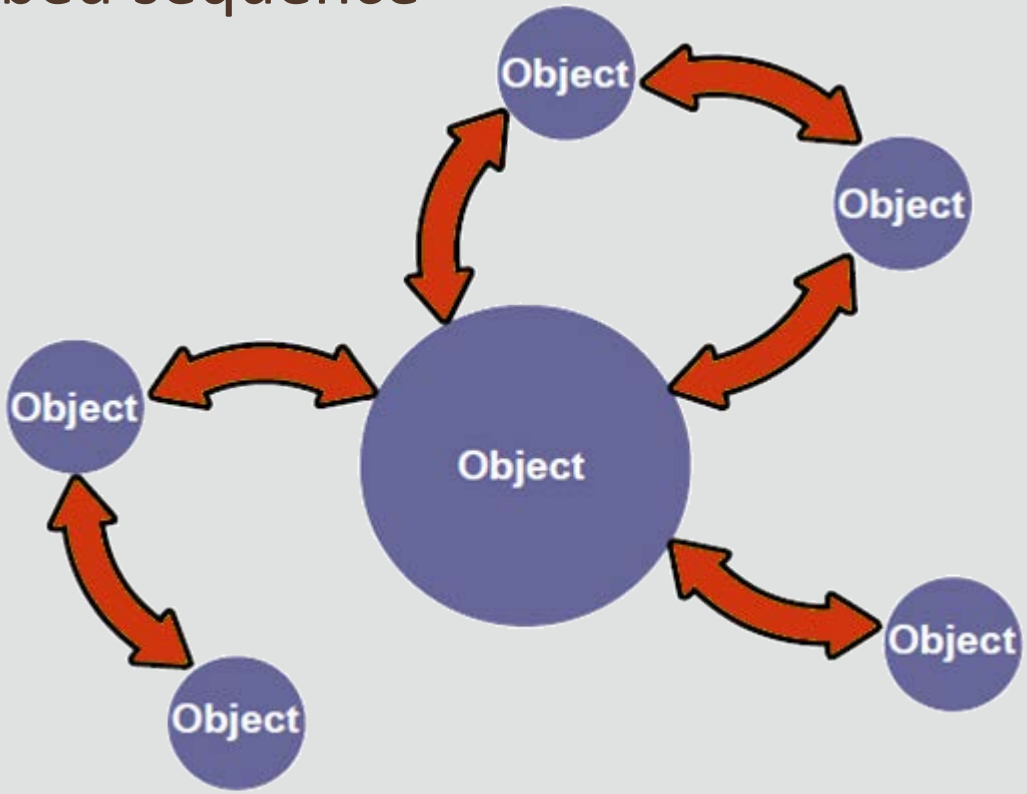
Java Can Do More!

- Procedural languages …
  - Read one line at a time
  - The C language is procedural

- Object-oriented languages…
  - Read one line at a time
  - Model objects through code
  - Emphasize object interaction
  - Allow interaction without a prescribed order
  - Java and C++ are object-oriented languages

Object-Oriented Programming

- Interaction of objects
- No prescribed sequence



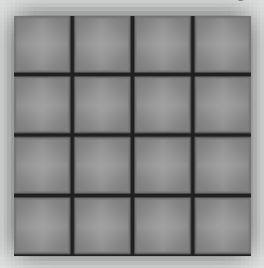
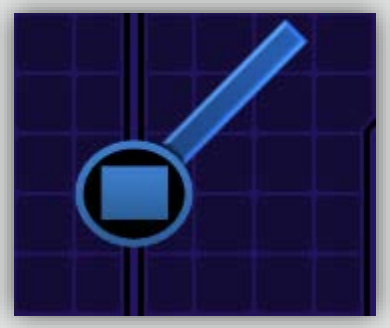
Exercise 1

- Go to https://objectstorage.uk-london-1.oraclecloud.com/n/lrvrlgaqj8dd/b/Games/o/JavaPuzzleBall/index.html
- Play Basic Puzzles 1 through 5
  - Your Goal: Design a solution that deflects the ball to Duke
- Consider the following:
  - What objects do you find on the field of play?
  - What happens when you put a triangle wall or simple wall icon on the blue wheel?

About Java Puzzle Ball

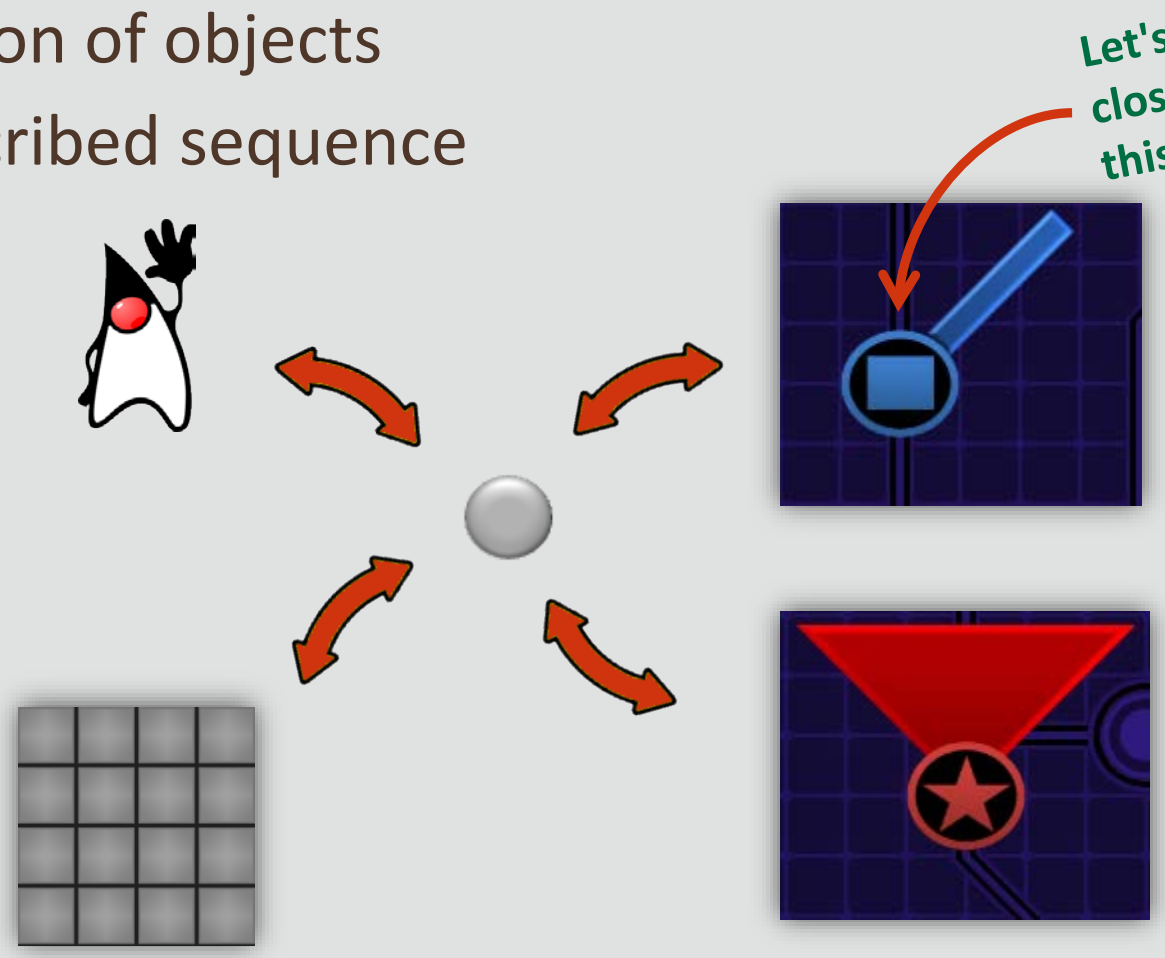
- Play a set of puzzles
- Become familiar with the game mechanics
- Consider questions as you play
- Listen to the lesson's debriefing on what you've observed
- Apply your observations to understand Java concepts

Object Types

- What objects did you find on the field of play?
  - Ball 
  - Duke 
  - LevelGeometry 
  - RedBumper 
  - BlueBumper 

Object Interaction

- Interaction of objects
- No prescribed sequence

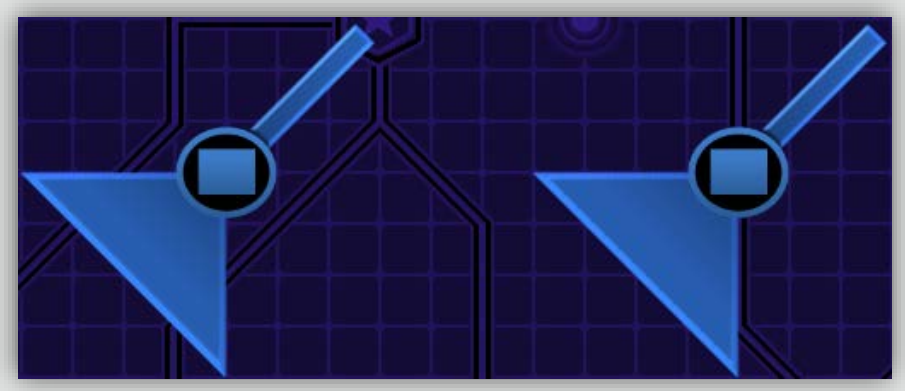


BlueBumper Objects

- What happens when you put a triangle wall or simple wall icon on a blue wheel?
- A wall appears on every instance of a blue bumper object
- Walls give bumpers behaviors that deflect and interact with the ball
- All blue bumper instances share these same behaviors

Describing a BlueBumper

- Properties:
  - Color
  - Shape
  - x-position
  - y-position



- Behaviors:
  - Make ping sound
  - Flash
  - Deflect ball (via Simple Wall)
  - Deflect ball (via Triangle Wall)

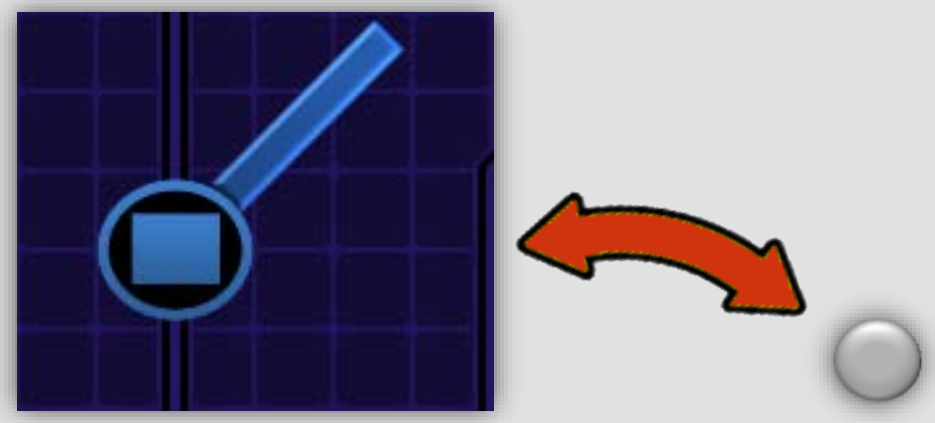
Describing a Ball

- Properties:
  - Direction
  - x-position
  - y-position

- Behaviors:
  - Make ping sound
  - Change direction
  - Change x-position
  - Change y-position

BlueBumper and Ball Interaction

- Interaction occurs when the BlueBumper deflects the Ball. When this happens …
- The Ball's properties change:
  - The Ball travels in a different direction
  - The Ball's future x-position and y-position change
- The BlueBumper performs behaviors:
  - Makes ping sound
  - Flashes



Why Does This Matter?

- We've observed important aspects of object-oriented programming
- Remember these observations as lessons and exercises become increasingly technical
  - Objects can be described as a combination of properties and behaviors
  - There may be many instances of the same object type
  - All instances of an object share the same behaviors
  - Objects may interact with each other, possibly affecting each other's properties and triggering other behaviors

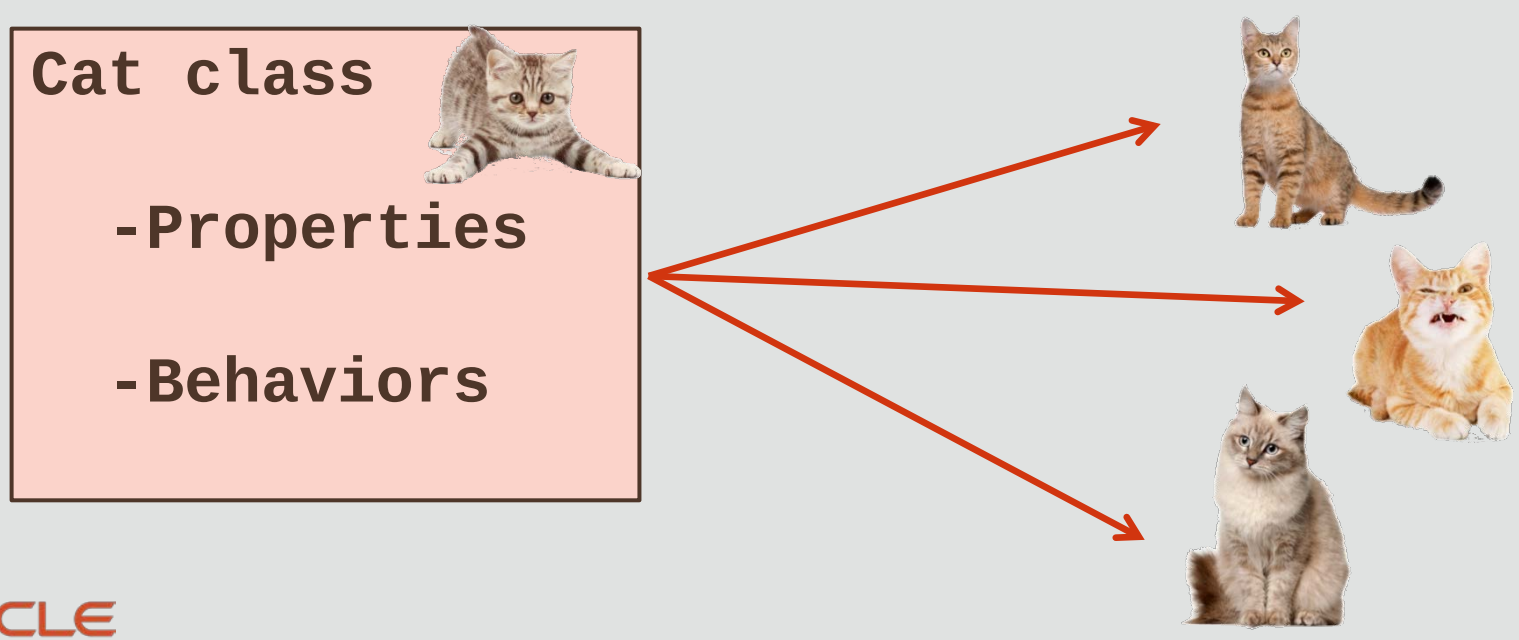
A Different Example

- Properties:
  - Name
  - Age
  - Breed
  - Favorite Food

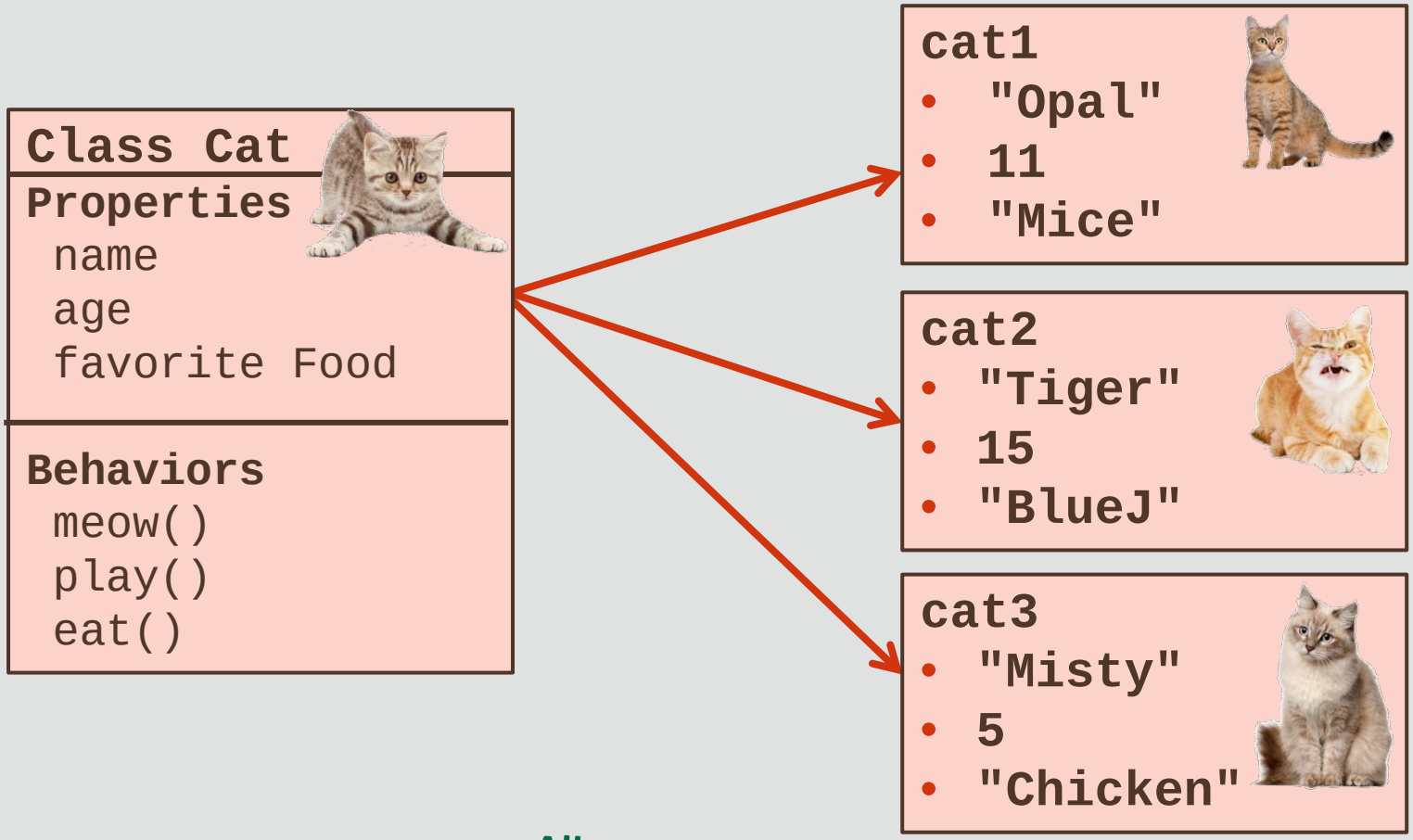
- Behaviors:
  - Make meow sound
  - Play
  - Wash
  - Eat
  - Hunt

Classes and Instances

- The combination of properties and behaviors is …
  - Called a class
  - A blueprint or recipe for an object
  - Used to create object instances



Creating New Instances from a Blueprint

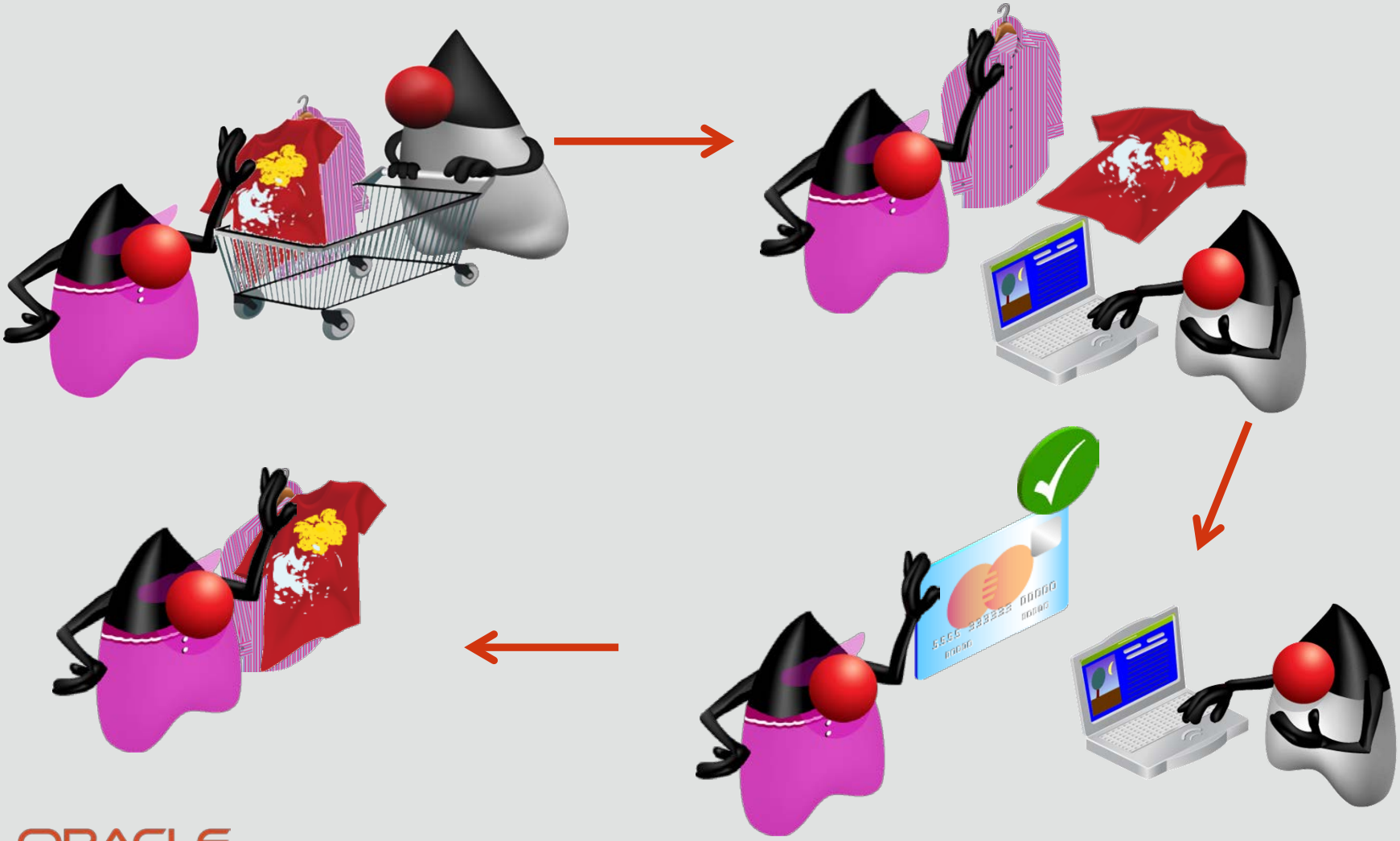


All cat instances share the ability to meow, play, and eat

Object-Oriented Strategy

- How do you write programs that achieve this level of flexibility?
- When you have an idea or requirement for a program …
  - Consider what type of objects may exist in this program
  - Consider the properties and behaviors of these object types
  - Consider how objects interact

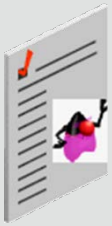
Duke's Choice Online Shopping



Characteristics of Objects

- Objects are physical or conceptual
- Objects have properties:
  - Size
  - Price
  - Color
- Objects have behaviors:
  - Shop
  - Put item in cart
  - Pay

Physical: Shirt



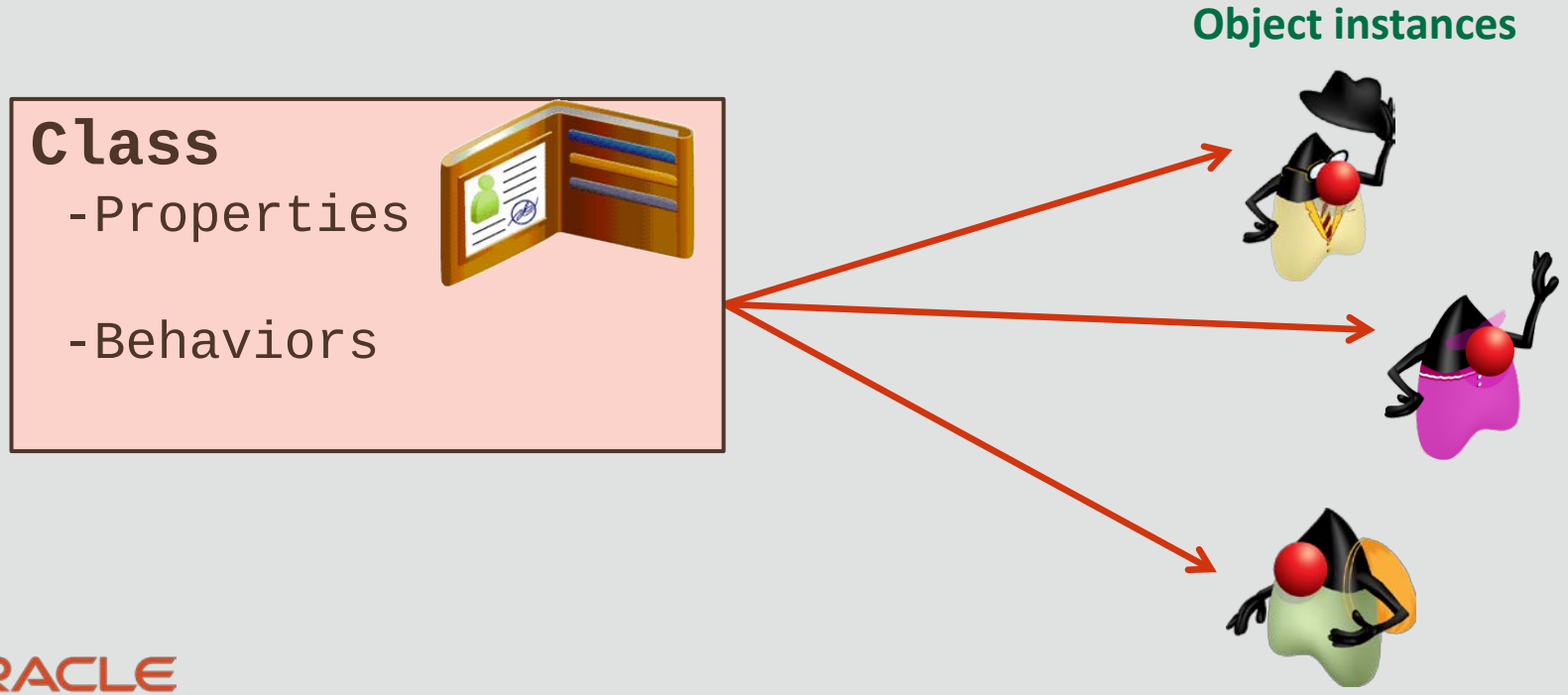
Conceptual: Online Account

Color property value is red

Mrs. Duke

Classes and Instances

- Remember, a class …
  - Is a blueprint or recipe for an object
  - Describes an object's properties and behaviors
  - Is used to create Object instances



Exercise 2, Part 1

- Given the following scenario, what objects could you potentially model to complete your program?
  - Design a program for a coin-sorting machine
  - This machine should measure, count, and sort coins based on their size or value
  - It should also print a receipt

- List at least 3 objects you would need to model for this example:
  -
  -
  -

Exercise 2, Part 2

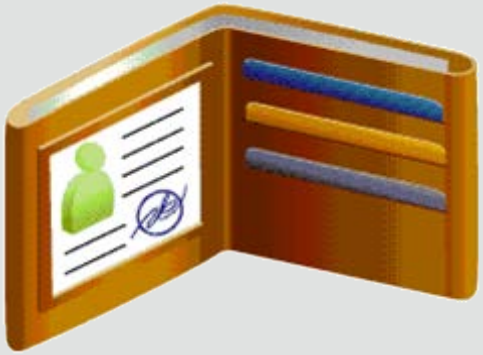
- Chose an object from Part 1
- What properties and behaviors of this object could you include in your program?

- Properties:
  -
  -
  -

- Behaviors:
  -
  -
  -

Customer Properties and Behaviors

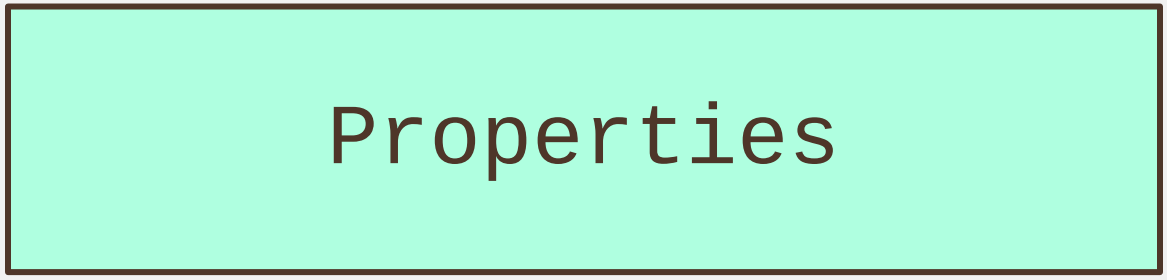
- Properties:
  - Name
  - Address
  - Age
  - Order number
  - Customer number



- Behaviors:
  - Shop
  - Set address
  - Add item to cart
  - Ask for a discount
  - Display customer details

Translating into Java Syntax

```
1  public class Customer {
2
3
4
5
6
7
8
9
10
11 }
```



Java Terminology

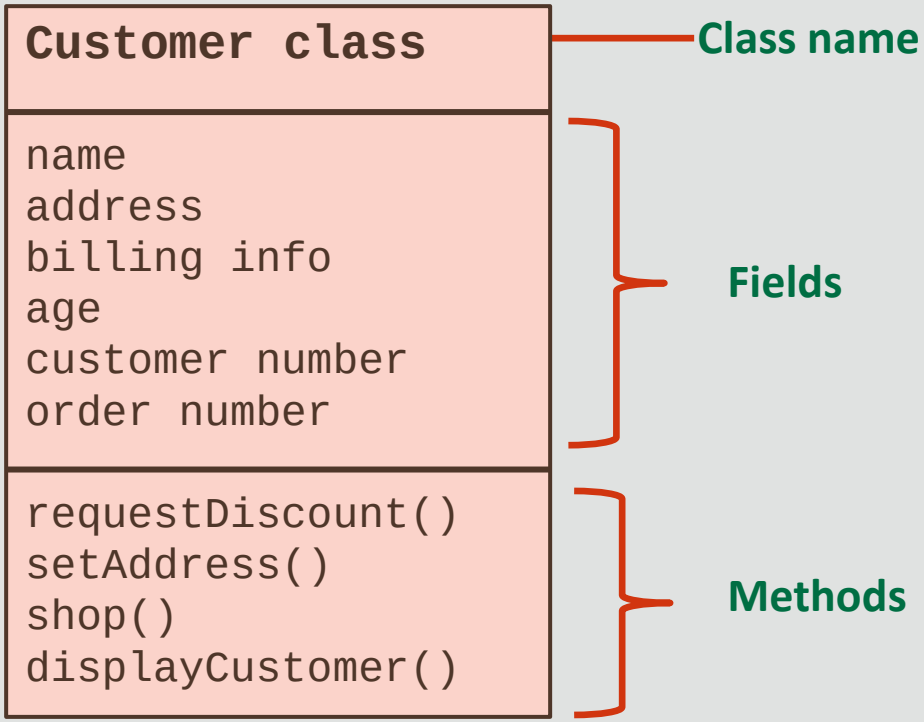
Class declaration

```
 1 public class Customer {
 2     public String name = "Junior Duke";
 3     public int    custID = 1205;
 4     public String address;
 5     public int    orderNum;
 6     public int    age;
 7
 8     public void displayCustomer(){
 9         System.out.println("Customer: "+name);
10     }//end method displayCustomer
11 }//end class Customer
```

Fields
(Properties)
(Attributes)

Methods
(Behaviors)

Modeling Properties and Behaviors



Data Fields

- Fields or Data Fields are the official Java terminology
- They're also called:
  - Properties
  - Attributes
  - Data Members
- Java has particular ways of representing data
  - Section 3 will take a closer look at data
  - We'll use the main method for this investigation
  - For now, it's alright to include a lot of code in the main method
  - BUT a large main method is strongly discouraged
  - Section 4 explores how to avoid this scenario

Summary

- In this lesson, you should have learned how to:
  - Differentiate between procedural and object-oriented programming
  - Understand a class as a blueprint for an object
  - Understand a class is used to create instances of an object
  - Model objects as a combination of …
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    - Behaviors (methods)


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